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The mature larva of *Gonioctena variabilis* Olivier, 1790 (Coleoptera, Chrysomelidae, Chrysomelinae) and key to the larvae of the subgenus *Spartoxena*

Andrés Baselga

Departamento de Zoología, Facultad de Biología, Universidad de Santiago de Compostela, c/ Lope Gómez de Marzoa s/n, 15782 Santiago de Compostela, Spain

Corresponding author: *Andrés Baselga* (andres.baselga@usc.es)

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Abstract

Mature larva of *Gonioctena (Spartoxena) variabilis* (Olivier, 1790) is described and illustrated for the first time, based on specimens collected on *Genista scorpius* (L.) DC. [Fabaceae] in central Spain. A key to known larvae of the subgenus *Spartoxena* is provided, and the diagnostic characters are illustrated. Diagnostic characters for the identification of species within the subgenus *Spartoxena* Motschulsky, 1860 are number of dorsal tubercles of abdominal segments, shape of tarsal claw, shape of labrum and disposition of microtrichia of epipharynx. Notes on the distribution and host plant of *G. variabilis* are included.

Keywords

Chrysomelidae, *Gonioctena*, *Spartoxena*, *Gonioctena variabilis*, larva, key

Introduction

The Holarctic genus *Gonioctena* Chevrolat, 1837 (Coleoptera: Chrysomelidae: Chrysomelinae) includes more than 70 species classified into nine monophyletic subgenera (Mardulyn et al. 1997). Eight species are currently recognized within *Spartoxena* Motschulsky, 1860 (Kippenberg 2001), which are distributed in southwest Europe (especially in the Iberian peninsula; four species) and north Africa. The taxonomy of adult stages of *Spartoxena* has been subject of considerable effort, with several taxonomic

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works clarifying the true status of several taxa from the Iberian Peninsula (Bechyné 1957) and North Africa (Bourdonné and Doguet 1979), besides two recent revisions based on male (Kippenberg 2001) and female genitalia (Baselga 2007).

Larval taxonomy of leaf beetles is far from complete, as we only know the larvae of about 22% of Chrysomelidae and 37% of Chrysomelinae of the Palaearctic region (Steinhausen 1996). The state of larval taxonomy of *Spartoxena* is reasonably good compared with percentages for its subfamily and family as the larvae of four species (50%) of *Spartoxena* are currently known: *G. gobanzi* (Reitter, 1902) from the Alps, which is included in the key for the Central European species (Steinhausen 1994), as well as *G. aegrota* (Fabricius, 1798), *G. leprieuri* (Pic, 1911) and *G. pseudogobanzi* Kippenberg, 2001 from the Iberian Peninsula, which were recently described and illustrated (Baselga and Novoa 2004; Baselga 2008). The aims of this paper are (i) to describe for the first time the mature larvae *G. (Spartoxena) variabilis* (Olivier, 1790), providing diagnostic characters for its identification, and (ii) to provide an identification key for the larvae of the subgenus *Spartoxena*.

Materials and methods

Mature larvae were collected along with adults by sweeping their host plants. Specimens were attributed to genus *Gonioctena* following Steinhausen (1994). The specific identity of larvae was assigned after determination of adults collected from the same plants. To ensure correct larval identification a few specimens were reared until pupation and adult emergence, confirming the assignation of larvae here described to *G. variabilis*. Larvae were preserved in 70% ethanol. Some specimens were cleared in warm 10% KOH and its tegument was mounted on microscope slides, as well as dissected cephalic and thoracic appendages. Slide mounts were prepared using dimethyl hydantoin formaldehyde resin (DMHF). Drawings were traced using CorelDraw 11 software, from images captured with a Nikon Coolpix 4500 digital camera attached to an Olympus SZ30 stereomicroscope and an Olympus BX-41 compound microscope. The morphological terminology follows Kimoto (1962) and Cox (1982).

Gonioctena (Spartoxena) variabilis Olivier, mature larva

Figs 1–3, 10

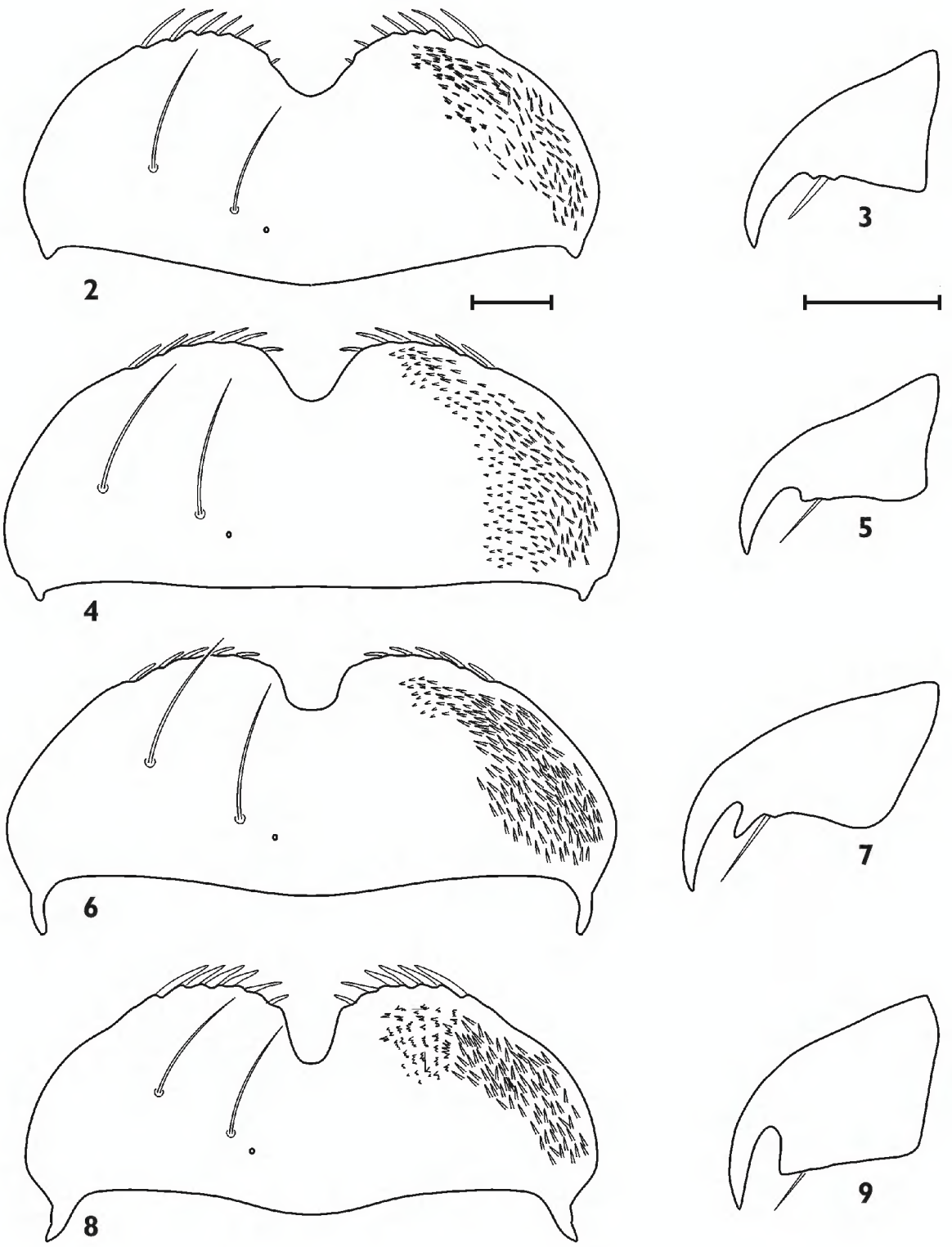
Material examined. SPAIN. Madrid, Perales de Tajuña (lat: 40.232; long: -3.888), 575 m asl, 2 June 2007, 8 mature larvae.

Description. Length: 8.0–9.5 mm. Body eruciform (Fig. 1), convex and slightly arched in preserved specimens. Inter-tubercular plates pale yellow-brown, tubercles pale brown in dorsal and ventral regions, dark brown in dorsolateral region.

Head. Hypognathous, well sclerotized. Great part of vertex and frons dark brown coloured, the anterior part of frons, clypeus and mouth parts, paler. Epicranial suture

Figure 1. Habitus of *Gonioctena variabilis*, mature larva from Perales de Tajuña. Length = 9.0 mm.

well developed and long, frontal arms distinct, V-shaped and almost straight. Endocarina present, extending almost to clypeus. Vertex bearing 5 large primary setae (v1, v3, v4, v5, v6) along with many shorter ones on each side. Frons with 5 primary setae (f1, f2, f3, f4, f6) and 8–10 slightly shorter ones on each side. Antennae very short and well



Figures 2–9. *Gonioctena* spp. **2** Labrum of *G. variabilis*, dorsal view. In the right side the setae were removed and the microtrichia of epipharynx are shown by transparency **3** Tarsal claw of *G. variabilis*, lateral view **4** Labrum of *G. aegrota*, dorsal view **5** Tarsal claw of *G. aegrota*, lateral view **6** Labrum of *G. pseudogobanzi*, dorsal view **7** Tarsal claw of *G. pseudogobanzi*, lateral view **8** Labrum of *G. leprieuri*, dorsal view **9** Tarsal claw of *G. leprieuri*, lateral view. Scale bars = 0.1 mm.

sclerotized, three-segmented: first joint highly transverse; second joint almost as long as wide, bearing a conical membranous sensillum, 3 minute setae and 1 placoid sensillum; distal joint narrow, subconical, with membranous apex bearing 5 highly minute setae and 1 placoid sensillum. Stemmata arranged in two groups, 1 pair located below the base of antenna and 2 pairs behind the antenna. Clypeus with 3 pairs of setae.

Mouthparts. Labrum (Fig. 2) bearing 2 pairs of setae and 1 pair of placoid sensilla on upper surface, anterior border with a wide V-shaped notch and 6–7 stout setae on

each side. Epipharynx with 2 bands of microtrichia situated laterally to anterior notch (Fig. 2), microtrichia completely isolated through the lateral margin but fused together to form groups of 2–3 denticles near central notch. Mandibles symmetrical, 5-toothed, bearing 2 setae on external face and 1 placoid sensillum on dorsal side. Maxillae: cardo transverse, with 1 seta in external border; stipes elongate, with 2 large setae near base of maxillary palp; mala bearing 13–15 setae on internal margin and apex, basal setae longer than apical ones, maxillary palpi 4-segmented, first joint slightly wider than long, bearing 2 long setae basally and another minute seta apically on external margin, second joint highly transverse, third joint longer than wide with 2 setae on internal face and 1 on external side, and fourth joint conical with 1 minute seta on internal face and membranous apex bearing 11–13 highly minute setae. Labium with postmentum membranous, bearing 3 pairs of setae, anterolateral one very short; prementum with 4 pairs of minute setae, 1 pair posterior and 3 pairs anterior to labial palpi along with 1 pair of placoid sensilla; palpi two-segmented, first joint transverse, distal joint conical with membranous apex bearing 10–11 highly minute setae.

Thorax. All tubercles multisetose (Fig. 10). Prothorax with tubercles D (dorsal), DL (dorsolateral) and EP (epipleural) fused together in a pronotal sclerite, pronotum (D-DL-EP) bearing 10 pairs of primary setae along with many other slightly shorter ones; tubercle P (pleural) with 4–6 setae; ventral region with slightly sclerotized tubercles, tubercle SS (sternellar) reduced to 3–4 sclerotized spots bearing 1 seta, midventral tubercle ES (eusternal) bearing 3 pairs of setae. Meso- and metathorax with 6 tubercles on each side of dorsal region: Dai (dorsal anterior interior, with 6–8 setae), Dae (dorsal anterior exterior, 6–8 setae), Dpi-Dpe (dorsal posterior interior and dorsal posterior exterior fused together, 8–10 setae), DLai (dorsolateral anterior interior, 2–4 setae), DLpi (dorsolateral posterior interior, 11–15 setae), DLae-DLpe (dorsolateral anterior exterior and dorsolateral posterior exterior fused together, 13–18 setae); epipleural region with 2 tubercles, EPa (epipleural anterior, 11–14 setae) and EPp (epipleural posterior, 5–8 setae); mesothoracic spiracle isolated from EPa tubercle, located in front of DLae-DLpe one; P tubercle bearing 4–6 setae; SS and ES tubercles reduced to numerous sclerotized dots bearing isolated setae.

Legs. All pairs similar in size; trochantin located in front of P tubercle (Fig. 10), bearing 1 minute setae in anterior half; prothoracic trochantin also with a larger seta in postero-ventral angle; coxa almost twice longer than wide in lateral view, with 10–11 large setae on dorsal face and 3–5 shorter ones in each lateral declivity; trochanter triangular in lateral view, with 2 large setae on each side, 1 minute seta and 4 placoid sensilla near coxal articulation on anterior side, and 2 placoid sensilla on posterior side; femur wider apically than basally in lateral view, with 2 large and 1 small setae dorsally, 3 large setae and 1 placoid sensillum on anterior side, and 2 large setae on posterior side; tibio-tarsus twice longer than wide, bearing 3 large and 1 minute setae dorsally and 4 ventrally; unguis wide basally, curved apically, with an extremely weak tooth and seta on lower side (Fig. 3).

Abdomen. All tubercles multisetose (Fig. 10). Segments 1–6 with 6 tubercles on each side of dorsal region: Dai (4–6 setae), Dae (6–7 setae), Dpi (6–9 setae), Dpe (7–9 setae),

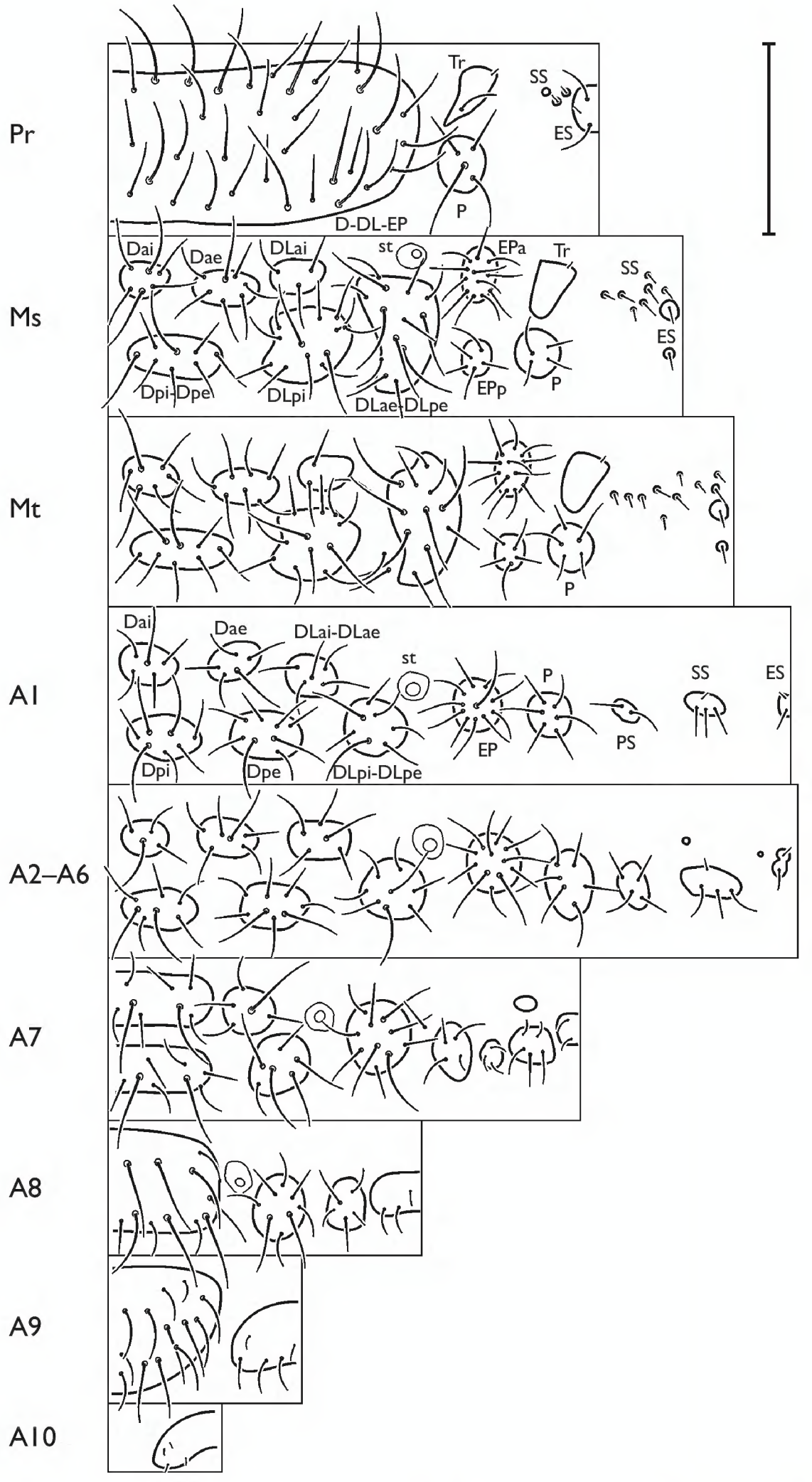


Figure 10. *Gonioctena variabilis*: location of tubercles and body chaetotaxy, right side. **Pr** prothorax **Ms** mesothorax **Mt** metathorax **A1–A10** abdominal segments 1–10. See text for definition of tubercles abbreviations. Scale bar = 1.0 mm.

DLai-DLae (4–6 setae) and DLpi-DLpe (6–9 setae); epipleural region with tubercle EP bearing 11–12 setae; spiracle isolated from EP tubercle, located in front of DLpi-DLpe one; P tubercle with 6–9 setae; sternal region presents the following tubercles: PS (parasternal, 2–5 setae), slightly reduced in segment 1, but always present and bearing 2 setae; SS (4–6 setae); ES separated in two halves, each one with 2–3 setae. Segment 7 with tubercle Dai fused to Dae, and Dpi to Dpe; segment 8 and 9 with all dorsal and dorsolateral tubercles fused together, ventral ones also fused in segment 9; segment 10 forming anal pseudopod, without dorsal tubercles, ventral ones fused together.

Distribution and ecology. *G. variabilis* is distributed in the east half of Spain and south France. In Spain it is distributed southwards to Madrid in the westernmost area and to Alicante in the easternmost range (Kippenberg 2001; Baselga 2007). Its host plant is *Genista scorpius* (L.) DC. [Fabaceae] (Kippenberg 2001). The larvae described in this paper were collected on the same plant [field identification]. *Genista scorpius* is known from the Iberian Peninsula but also from southern France and northern Morocco. Its Iberian range includes almost the whole peninsula, excepting the western third (Talavera 1999). Hence the distribution range of *G. variabilis*, seems closely related to that of its host plant, although it does not reach the western and southernmost regions where *G. scorpius* is present. This pattern could be real, as phytophagous insects usually have narrower distribution ranges than their hosts (Gaston 2003), but further research is needed to clarify to which extent southern and western limits of *G. variabilis* differ of those of its host plant.

Discussion

The mature larva of *G. variabilis* presents all the diagnostic characters given by Cox (1982) and Steinhausen (1994) for the identification of the genus *Gonioctena*: body dorsally not strongly convex, labrum with 2 pairs of setae, pronotum bearing a high number of setae on disc, dorsolateral tubercles of meso-, metathorax and abdomen without eversible glands, tarsal claws toothed on lower side. Of the 18 species of western Palaearctic *Gonioctena* with known larva (Steinhausen 1996; Baselga and Novoa 2004; Baselga 2008), four belong to the subgenus *Spartoxena*: *G. aegrota*, *G. gobanzi*, *G. leprieuri* and *G. pseudogobanzi*. The mature larva of *G. variabilis* shares the following diagnostic characters of *Spartoxena* (Baselga 2008) with other members of the subgenus: (i) frons with two dark spots, (ii) frons with 5 primary setae along with more than 7 slightly shorter setae on each side, (iii) abdomen with dorsal tubercles not fused together.

The five larvae currently known within the subgenus show a high interspecific similarity. At the larval stage, *Spartoxena* species can be accurately identified based only on a limited number of diagnostic characters: the number of dorsolateral tubercles, the shapes of labrum and tarsal claw, and the disposition of microtrichia in the epipharynx. The first character allows the separation of *G. gobanzi* from the remaining species, as *G. gobanzi* presents three dorsolateral tubercles (Steinhausen 1994: Fig. 216), instead of two dorsolateral tubercles as the four Iberian species (Baselga and Novoa 2004; Baselga

2008), including *G. variabilis* (Fig. 10). Among these species, *G. variabilis* can be distinguished by the parasternal tubercle of the first abdominal segment, which is only partially reduced and bearing 2 setae (Fig. 10), whereas it is extremely reduced and bearing only 1 seta in the remaining species (Baselga and Novoa 2004; Baselga 2008). The shape of the median V-shaped notch of the labrum (Fig. 2) and the effaced tarsal claw (Fig. 3), also allow separating *G. variabilis* from *G. leprieuri* and *G. pseudogobanzi*, in which the median notch of labrum is U-shaped (Figs 6, 8) and the tarsal claw is well marked (Figs 7, 9). By these two characters, *G. variabilis* is most similar to *G. aegrota* (Figs 4–5), from which the species described here can be distinguished by just the parasternal tubercle of the first abdominal segment and, less clearly, by the shape of tarsal claw and the disposition of microtrichia in the epipharynx: (i) tarsal claw is almost totally effaced in *G. variabilis* (Fig. 3), instead of weak but well delineated in *G. aegrota* (Fig. 5), and (ii) microtrichia of epipharynx form groups of 2–3 denticles near the central notch in *G. variabilis* (Fig. 2), whereas they are mostly isolated or sometimes paired in *G. aegrota* (Fig. 4).

Key to known larvae of the subgenus *Spartoxena*

1. Abdominal segments 1–6 with four dorsal and three dorsolateral tubercles on each side (Steinhausen 1994: Fig. 216). Southern Alps ..... ***G. gobanzi* (Reitter)**
– Abdominal segments 1–6 with four dorsal and two dorsolateral tubercles on each side (Fig. 10) **2**
2. Tarsal claws with a weak tooth on ventral side (Figs 3, 5). Labrum with a wide V-shaped notch (Figs 2, 4) **3**
– Tarsal claws with a marked tooth on ventral side (Figs 7, 9). Labrum with a wide U-shaped notch (Figs 6, 8) **4**
3. PS tubercle in abdominal segment 1 extremely reduced to an isolated seta (Baselga and Novoa 2004: Fig. 11). Tarsal claws weak but well delineated (Fig. 5). Microtrichia of epipharynx mostly isolated or sometimes paired (Fig. 4). Western and southern Iberian peninsula and northern Morocco..... ..... ***G. aegrota* (Fabricius)**
– PS tubercle in abdominal segment 1 slightly reduced but always well visible and bearing 2 setae (Fig. 10). Tarsal claws almost completely effaced (Fig. 3). Microtrichia of epipharynx isolated through lateral margins but fused together to form groups of 2–3 denticles near central notch (Fig. 2). Eastern and northern Iberian peninsula and southern France ..... ***G. variabilis* (Olivier)**
4. Tarsal claws with a broad tooth (Fig. 9). Labrum with a deep U-shaped notch (Fig. 8). Microtrichia of epipharynx isolated through lateral margins but fused together to form ridges of 3–5 denticles near the central notch (Fig. 8). Northwest quarter of the Iberian peninsula ..... ***G. leprieuri* (Pic)**
– Tarsal claws with an acute tooth (Fig. 7). Labrum with a shallow U-shaped notch (Fig. 6). Microtrichia of epipharynx mostly isolated or sometimes paired (Fig. 6). South-east Iberian peninsula ..... ***G. pseudogobanzi* Kippenberg**

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